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THE STATUS OF *PAPILIO MACHAON RATHJENSI* AND
ITS RELATIONSHIP TO OTHER ARABIAN POPULATIONS
(PAPILIONIDAE)

In 1931 Dr. C. Rathjens captured a series of 4 male and 3 female specimens of *Papilio machaon* Linné 1758 near Sana'a in the high mountains of the present Yemen Arab Republic. This locality was some 1200 km from the closest known locality of *machaon* at Hofuf in eastern Saudi Arabia. It was described as ssp. *rathjensi* by Warnecke in 1932 (Int. Ent. Z., 25: 473-476). The chief characteristic of this subspecies is the broad black band of the hindwing upperside which reaches the cell and even encroaches upon it; together with the strongly blackened base of the hindwings this lends *rathjensi* a very distinctive appearance. It is certainly one of the best defined subspecies of *machaon*. The type series, which remained unique, appears to have been destroyed in the giant bombing raids on Hamburg during the second world war.

Eller (1936, Abh. Bayer. Akadem. Wiss., Math.-Nath., NF36; 1939, Verh. VII Int. Kongr. Ent., Berlin, 1: 74-101) on morphological grounds believed that *rathjensi* was allied to ssp. *saharae* Oberthür, a subdesert form distributed along the fringes of the Sahara from Morocco to the Sinai. Eller was not permitted to dissect a specimen to check whether the harpe in the male genitalia of *rathjensi* matched the characteristic reduced harpe of *saharae*. Seyer, in a recent revision of *machaon* (1974, Mitt. Ent. Ges. Basel, 24: 64-117 and 26: 65-87, 97-145), was able to take the matter no further, hardly mentioning the Arabian taxa.

Thanks to the kindness of Mr. P. Carden I obtained two specimens of *P. machaon rathjensi* collected near Taizz, elev. 1100 m, in 1974 when he was ambassador of Great Britain to the Yemen Arab Republic. In all respects they match the original description and its accompanying photographs. On dissection the harpe of the male genitalia was found to match that of ssp. *saharae* (see Fig. 1). In addition to the differences in morphology and genitalia, the larva of ssp. *saharae* differs from other subspecies of *machaon* (Clarke & Sheppard 1956, Evolution 10: 66-73), but unfortunately nothing is known about the biology of *rathjensi*. It is well known that the male genitalia of butterflies is subject to both individual and geographic variation. Turner (1963, Trans.

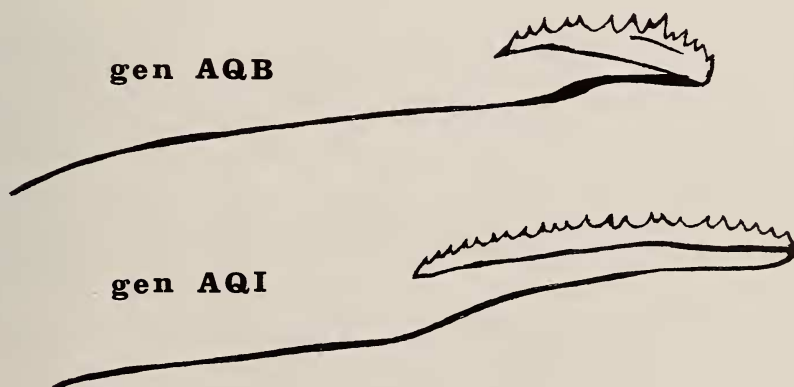


FIG. 1. The harpe of the male valve in *Papilio machaon*. Gen AQB illustrates spp. *rathjensi* from Yemen; gen AQI ssp. *syriacus* from the Hofuf area (codes refer to the author's slide collection).



FIG. 2. *Papilio machaon* from Arabia. Top row, ssp. *rathjensi* from Yemen; bottom left, ssp. *syriacus* from the oasis at Hofuf in eastern Saudi Arabia; bottom right, ssp. *muetingi* from Oman (slightly smaller than natural size).

R. Ent. Soc. Lond. 115: 239-259) illustrates this well in the African *Papilio dardanus* Brown. However, given the fact that literally thousands of *P. machaon* from all over its range have been dissected, none of which show the degree of reduction in harpe found in *saharae*, one feels safe in assuming a close relationship between *rathjensi* and *saharae*.

That this should be so is most interesting since the other Arabian populations of *machaon* are not related to *saharae*. That of the Hofuf oasis (ssp. *arabensis* Eller (*nomen nudum*)) is probably best referred to ssp. *syriacus* Verity, though there are small differences in detail (form of tail, form of median band on the forewings). That of northeastern Oman is clearly ssp. *muetingi* Seyer (= *iranus* Eller (*nomen nudum*)). Both of these populations have the normal long harpe structure; a specimen from Hofuf is shown in Fig. 1.

These findings invalidate the otherwise attractive suggestion made by Wiltshire (1945, Proc. R. Ent. Soc. Lond. 20: 6-25) that *machaon* invaded the high mountains of Yemen along the Red Sea coast and subsequently moved northeast to Hofuf. They certainly invaded independently. *P. machaon syriacus* still exists in the Jordanian deserts. Probably scattered populations of *machaon* survived in Central Arabia until recently, but the gradual desiccation processes of the past 5000 years forced it to adapt to oasis conditions, hence its current isolation in the huge oasis complex around Hofuf. Although Oman has more rain and more dependable rainfall than eastern Saudi Arabia, the Omani population has also largely adapted to oasis conditions. Despite the distance, *P. machaon syriacus* could be a recent immigrant rather than a relict. However, circumstantial evidence supports the relict theory. First, there are relict populations of other Palaearctic species in the area which are decidedly non-migratory, the most

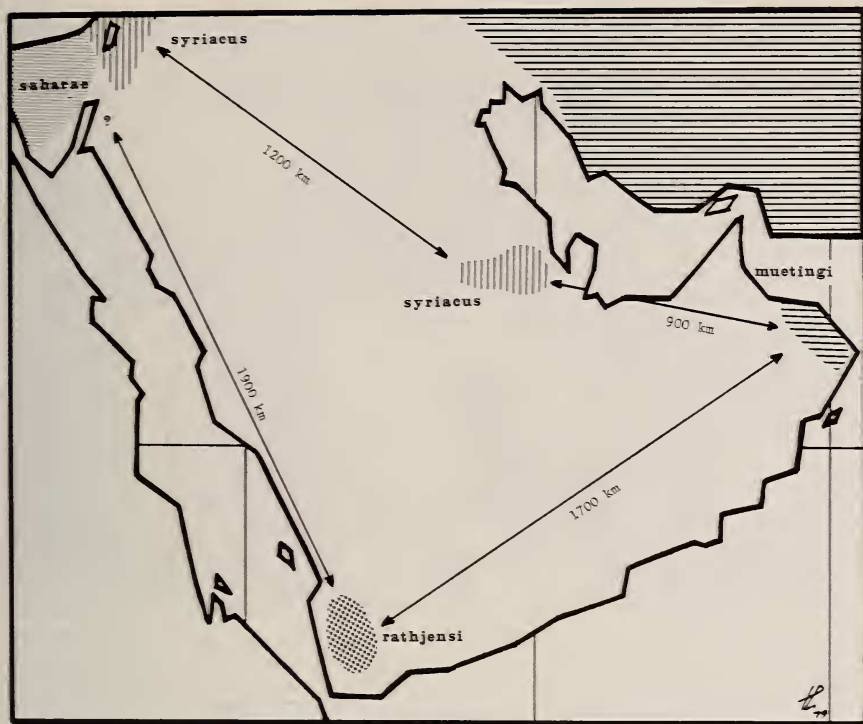


FIG. 3. Distribution of *Papilio machaon* in Arabia. Populations of *machaon* most closely related to *ssp. syriacus* extend to Bagdad in Iraq just north of the map.

important in the Rhopalocera being *Melitaea persea sargon* Hemming. Second, *ssp. iranus* would have been much more likely to colonize than *syriacus* (Fig. 3).

Zoogeographically we are faced with an interesting situation. Arabia, which is currently populated by a mixture of Palaearctic migrant species, eremic species and tropical species, contains three well established and totally isolated populations pertaining to three different subspecies of the typically Palaearctic, non-migratory *Papilio machaon*. *Ssp. rathjensi* probably invaded Yemen during an interglacial period; *ssp. syriacus* probably was widely distributed in central parts of Arabia during the postglacial pluvial optimum and is thus a recent isolate. It is in the process of subspeciation and has been forced to adapt to an oasis environment. The Omani populations of *ssp. muetingi* are isolated from the Iranian by water but it is doubtful whether the distances are sufficient to ensure that gene flow between Omani and Iranian populations has been totally cut off.

TORBEN B. LARSEN, 23 Jackson's Lane, London N.6. England.